



High Risk Stream Crossings in Greenfield, MA:

A Resource for Assessing Risk and Improving Resiliency

Franklin Regional Council of Governments

September 2018

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Introduction and Project Background

This report provides a summary of the road-stream crossings (culverts and bridges) in the City of Greenfield that are considered to be at high risk of failure from heavy precipitation events. The purpose of this project is to help municipal officials and public works staff prioritize bridge and culvert upgrades in their towns. This report also provides information on how to make road-stream upgrades more resilient to current and projected precipitation conditions. Roads, bridges, and culverts in the Deerfield River Watershed are particularly vulnerable to flooding, as Tropical Storm Irene demonstrated in 2011. Events like Tropical Storm Irene are projected to become more frequent due to climate change. Upgrading and replacing culverts and bridges with structures that can withstand higher flows will save money over the long term, help protect critical infrastructure, and improve aquatic habitat in the watershed.

The information in this report comes from a pilot project completed by the Massachusetts Department of Transportation (MassDOT) and the University of Massachusetts, Amherst (UMass). The intent of the project was to develop a methodology for determining the vulnerability of inland transportation networks to climate change, and specifically, to extreme precipitation events. The analysis identified and mapped road-stream crossings in each town within the Deerfield River Watershed. Over 900 crossings were evaluated through field work completed by Trout Unlimited. The analysis looked at five factors (Figure 1) when considering vulnerability of a crossing. An interactive online tool, SHEDS: Stream Crossing Explorer,¹ was created showing the results of the evaluations, and is described in more detail on pages 19 to 24.

¹ <http://sce.ecosheds.org/>

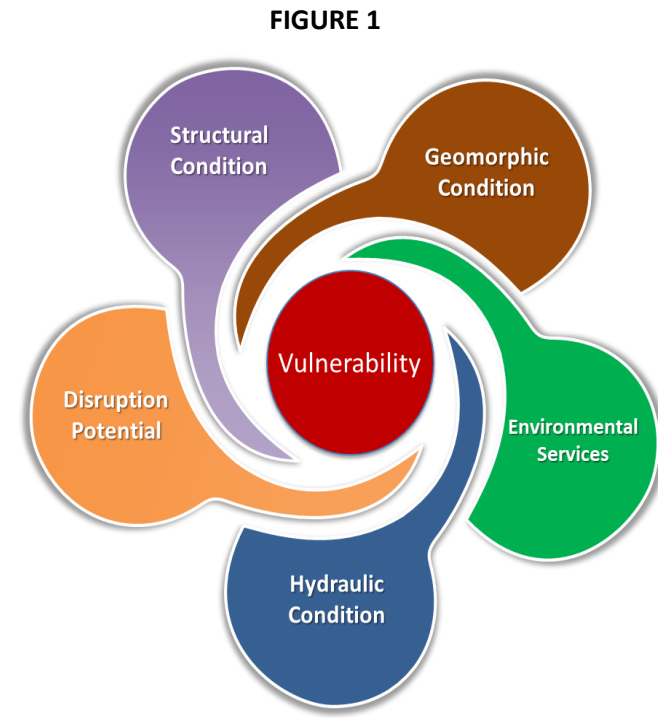


Figure 1: The MassDOT project considered five factors when determining overall vulnerability of a crossing: structural condition; geomorphic condition; hydraulic condition; disruption of emergency response; and the potential to improve aquatic organism passage. Image source: UMass Amherst

Definitions

For the purpose of this report, the crossings identified as having a high Overall Risk of Failure in the SHEDS tool have been included. These crossings are vulnerable due to one or more of the following factors:

- **Structural Condition** – Risk of failure is based on the structural condition of the crossing. Data comes from MassDOT bridge inspection reports or culvert condition assessments conducted in the field by Trout Unlimited or UMass Amherst students.
- **Hydraulic Risk** – Risk of failure is based on how much water a crossing can handle before collapsing, overtopping, or washing out. Hydraulic Risk was determined through models of current and future stream flows for different storm events.
- **Geomorphic Risk** – Risk of failure is based on the likelihood of sediment plugging, woody debris, and channel adjustment at the crossing structure. A geomorphic scoring index was used to assess each crossing for structural alignment, structure width versus stream channel width, stream power versus substrate type, evidence of deposition or erosion, condition of the structure's footings, existence of a scour pool, and existing blockage.

Massachusetts Stream Crossing Standards

The Massachusetts Stream Crossing Standards² apply to all new permanent crossings, and to replacement crossings to the extent feasible. The standards were created to protect and improve stream health by designing culverts and bridges to accommodate fish and wildlife passage. Common problems for fish and wildlife passage at crossings (Figure 2) also tend to place these crossings at a higher risk for failure during a flood event. While the standards focus on improving river and stream ecosystems, designing crossings with rivers in mind also makes those structures more resilient to flooding, allowing for larger volumes of water and debris to safely pass through.

The Stream Crossing Standards establish minimum criteria necessary for fish and wildlife movement and to maintain stream continuity (Figure 3). Further engineering is required to determine appropriate size and design to provide adequate flood capacity and stability. The Massachusetts Department of Transportation (MassDOT) updated its *Design of Bridges and Culverts for Wildlife*

² <https://www.mass.gov/files/documents/2018/08/23/Stream%20Crossings%20booklet%20Web.pdf>

*Passages at Freshwater Streams*³ to incorporate the most recent Stream Crossing Standards and to provide design templates and guidance for municipal officials. The new guidance document is expected to be available in January 2019.

High Risk Crossing Tables

The following tables display the high risk road-stream crossings in Greenfield. Each crossing has a Map ID that corresponds to a number on the High Risk Crossing Map. The Crossing ID for each entry was used to download data from two sources: the SHEDS Stream Crossing Explorer tool (data source for Overall Risk of Failure assessment), and the North Atlantic Aquatic Connectivity Collaborative (NAACC, data source for photos and Aquatic Passability assessment). The Crossing ID can be used to look-up crossings in either of these data sources (see the Instructions for Using Stream Crossing Data Tools).

FIGURE 2

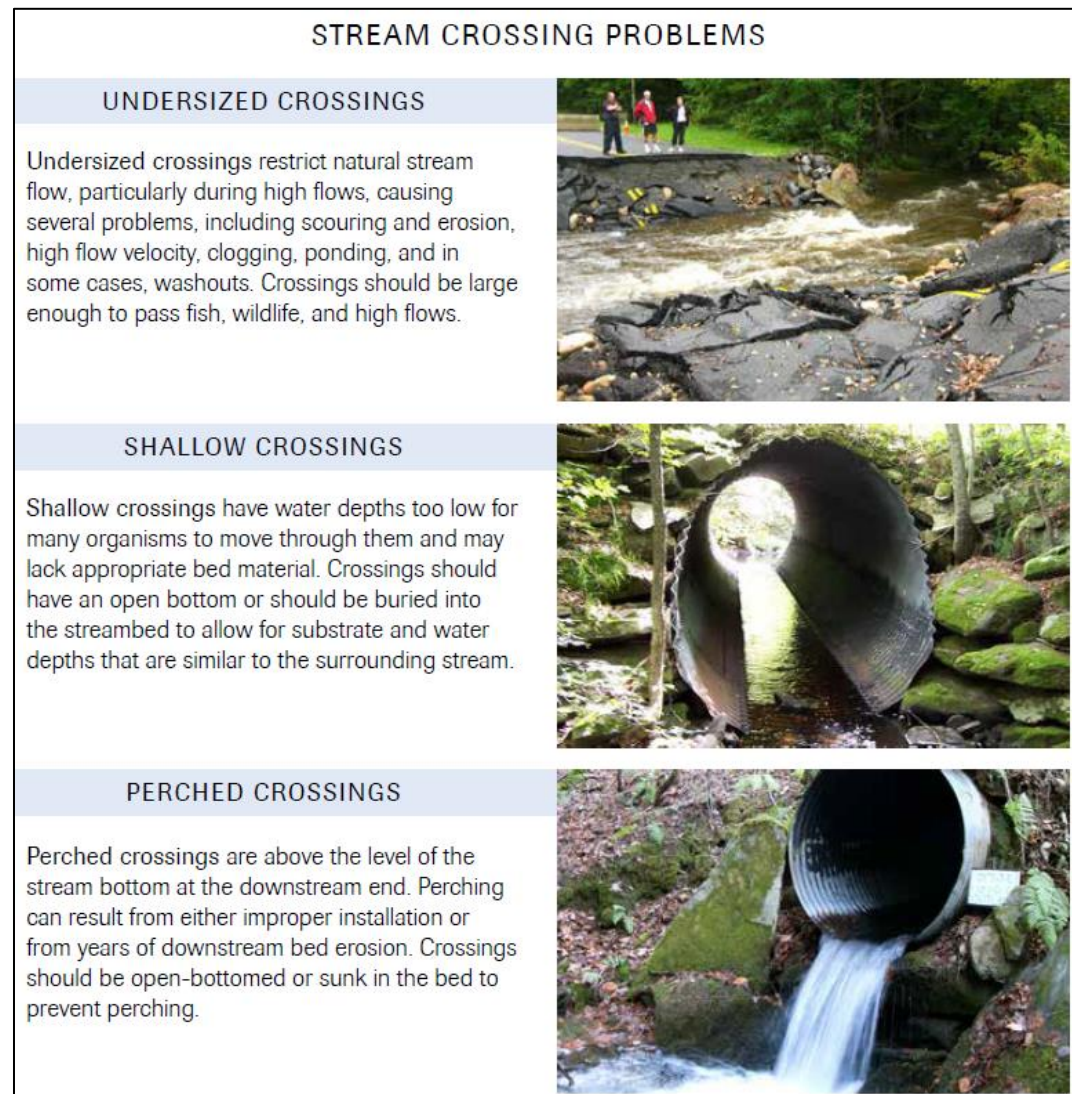


Figure 2: Common stream crossing problems for wildlife also tend to make crossings more vulnerable to failure during a flood event. Source: Massachusetts Stream Crossings Handbook, MA Division of Ecological Restoration, June 2012.

³ https://roadecology.ucdavis.edu/files/content/projects/MA_DOT_Design_Bridges_Culverts_Wildlife_Passage_122710.pdf

FIGURE 3



Figure 3: Good stream crossing design for wildlife also helps pass higher volumes of water and debris, making structures more resilient to heavy precipitation events. Source: Massachusetts Stream Crossings Handbook, MA Division of Ecological Restoration, June 2012.

GREENFIELD

Map ID	111
Road / Surface	Railroad
Stream	Green River
Crossing Type	Bridge
Jurisdiction	Private
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	
Hydraulic Risk	✓
Aquatic Passability	Full Passage
Observation Date	10/7/2014
GPS Coordinates	Latitude: 42.585191 Longitude: -72.611499
Crossing ID	xy4258519172611499



Map ID	112
Road / Surface	Country Club Rd / Paved
Stream	Mill Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	✓
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Significant Barrier
Observation Date	6/23/2014
GPS Coordinates	Latitude: 42.626995 Longitude: -72.59123
Crossing ID	xy4262699672591236



GREENFIELD

Map ID	113
Road / Surface	Green River Rd / Paved
Stream	Punch Brook
Crossing Type	Multiple Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Moderate Barrier
Observation Date	6/24/2014
GPS Coordinates	Latitude: 42.625229 Longitude: -72.631816
Crossing ID	xy4262522672631811



Map ID	114
Road / Surface	Colrain Rd / Paved
Stream	Allen Brook
Crossing Type	Multiple Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	
Hydraulic Risk	✓
Aquatic Passability	Insignificant Barrier
Observation Date	9/24/2014
GPS Coordinates	Latitude: 42.611982 Longitude: -72.632919
Crossing ID	xy4261198272632919



GREENFIELD

Map ID	115
Road / Surface	Leyden Rd / Paved
Stream	Glen Brook
Crossing Type	Open Bottom Arch
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	
Hydraulic Risk	✓
Aquatic Passability	Insignificant Barrier
Observation Date	6/20/2014
GPS Coordinates	Latitude: 42.643311 Longitude: -72.610111
Crossing ID	xy4264330372610115



Map ID	116
Road / Surface	Glenbrook Rd / Paved
Stream	Glen Brook
Crossing Type	Bridge
Jurisdiction	Unknown
Overall Risk of Failure	High
Structural Risk	✓
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Insignificant Barrier
Observation Date	6/20/2014
GPS Coordinates	Latitude: 42.642442 Longitude: -72.60982
Crossing ID	xy4264245372609826



GREENFIELD

Map ID	117
Road / Surface	Off Leyden Rd / Unpaved
Stream	Glen Brook
Crossing Type	Bridge
Jurisdiction	Unknown
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Insignificant Barrier
Observation Date	6/23/2014
GPS Coordinates	Latitude: 42.633981 Longitude: -72.61269
Crossing ID	xy4263398172612690



Map ID	118
Road / Surface	Deforest Rd / Unpaved
Stream	Glen Brook
Crossing Type	Bridge
Jurisdiction	Unknown
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	
Hydraulic Risk	✓
Aquatic Passability	Minor Barrier
Observation Date	6/23/2014
GPS Coordinates	Latitude: 42.639808 Longitude: -72.610058
Crossing ID	xy4263980872610058



GREENFIELD

Map ID	119
Road / Surface	Leyden Rd / Paved
Stream	Trib Mill Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Moderate Barrier
Observation Date	6/13/2016
GPS Coordinates	Latitude: 42.622815 Longitude: -72.609727
Crossing ID	xy4262281572609727

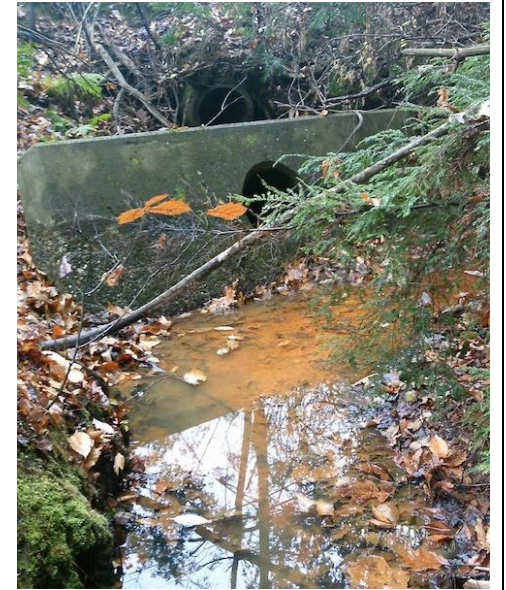


Map ID	120
Road / Surface	Colrain St / Paved
Stream	Green River
Crossing Type	Bridge
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	
Hydraulic Risk	✓
Aquatic Passability	Insignificant Barrier
Observation Date	10/7/2014
GPS Coordinates	Latitude: 42.590913 Longitude: -72.615377
Crossing ID	xy4259091372615377



GREENFIELD

Map ID	121
Road / Surface	I-91 SB / Paved
Stream	Trib Mill Brook
Crossing Type	Single Culvert
Jurisdiction	State
Overall Risk of Failure	High
Structural Risk	✓
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Severe Barrier
Observation Date	11/12/2014
GPS Coordinates	Latitude: 42.622809 Longitude: -72.588631
Crossing ID	xy4262280972588631



Map ID	122
Road / Surface	Newell Pond PI / Paved
Stream	Trib Mill Brook
Crossing Type	Bridge
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Minor Barrier
Observation Date	6/24/2014
GPS Coordinates	Latitude: 42.636373 Longitude: -72.574479
Crossing ID	xy4263637372574479



GREENFIELD

Map ID	123
Road / Surface	Spring Terrace / Paved
Stream	Graves Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Significant Barrier
Observation Date	6/17/2015
GPS Coordinates	Latitude: 42.588366 Longitude: -72.59076
Crossing ID	xy4258836672590760



Map ID	124
Road / Surface	Crescent St / Paved
Stream	Graves Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Minor Barrier
Observation Date	6/16/2015
GPS Coordinates	Latitude: 42.586458 Longitude: -72.590473
Crossing ID	xy4258645872590473



GREENFIELD

Map ID	125
Road / Surface	Mountain Rd / Unpaved
Stream	Graves Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Minor Barrier
Observation Date	9/24/2014
GPS Coordinates	Latitude: 42.580826 Longitude: -72.590513
Crossing ID	xy4258082672590513



Map ID	126
Road / Surface	Cheapside St / Paved
Stream	Graves Brook
Crossing Type	Single Culvert
Jurisdiction	State
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Significant Barrier
Observation Date	6/17/2015
GPS Coordinates	Latitude: 42.570982 Longitude: -72.587467
Crossing ID	xy4257098272587467



GREENFIELD

Map ID	127
Road / Surface	Keets Rd / Paved
Stream	Trib Deerfield River
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Significant Barrier
Observation Date	6/16/2015
GPS Coordinates	Latitude: 42.559941 Longitude: -72.585627
Crossing ID	xy4255994172585627



Map ID	128
Road / Surface	I-91 / Paved
Stream	Smead Brook
Crossing Type	Multiple Culvert
Jurisdiction	State
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Significant Barrier
Observation Date	10/28/2014
GPS Coordinates	Latitude: 42.587093 Longitude: -72.621342
Crossing ID	xy4258709372621342



GREENFIELD

Map ID	130
Road / Surface	Millbrook Rd / Paved
Stream	Mill Brook
Crossing Type	Single Culvert
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	
Geomorphic Risk	✓
Hydraulic Risk	✓
Aquatic Passability	Minor Barrier
Observation Date	6/23/2014
GPS Coordinates	Latitude: 42.644168 Longitude: -72.571505
Crossing ID	xy4264416872571505



Map ID	188
Road / Surface	Shelburne Rd / Paved
Stream	Smead Brook
Crossing Type	Bridge
Jurisdiction	Local
Overall Risk of Failure	High
Structural Risk	✓
Geomorphic Risk	✓
Hydraulic Risk	
Aquatic Passability	Minor Barrier
Observation Date	10/7/2014
GPS Coordinates	Latitude: 42.581518 Longitude: -72.642388
Crossing ID	xy4258152272642386





High Risk Stream Crossings Greenfield, MA

Instructions for Using Stream Crossing Data Tools

This report utilized two online data tools to compile the information in the stream crossing tables and map. Each of these tools contains a wealth of additional data and information that may be of interest to Town staff and officials. The following section will provide basic instructions on how to use each tool, and will show examples of additional information available.

North Atlantic Aquatic Connectivity Collaborative (NAACC)

The NAACC is a participatory network of practitioners including the University of Massachusetts Amherst and The Nature Conservancy, who are united in their efforts to enhance aquatic connectivity. The NAACC has developed protocols, tools, and trainings to assess and identify road-stream crossings that are problematic from an aquatic connectivity perspective. NAACC's online database serves as a common repository for crossing assessment data.

To access the online database go to https://www.streamcontinuity.org/cdb2/naacc_search_crossing.cfm

Select Massachusetts under the "Location" tab. Then select your town.

Under the "Choose Data Sets" tab, select NAACC (after 6/1/2015)

Then select "Search"

A list of culverts will appear below the search box (you may need to scroll down to see the search results).

FIGURE 4

The screenshot shows the NAACC online search interface. The browser address bar displays the URL: https://www.streamcontinuity.org/cdb2/naacc_search_crossing.cfm. The page header includes the NAACC logo and the text "North Atlantic Aquatic Connectivity Collaborative" with links for "Search Crossings" and "Login". The search form is divided into several sections: "Location (choose multiple towns, watersheds):" with a dropdown menu showing "All States [37115]"; "Other:" with fields for "Survey ID:" and "Crossing Code:"; "Dates:" with fields for "Last updated from ...", "Last updated until ...", "Date observed from ...", and "Date observed until ..."; "Personnel:" with dropdowns for "Any Observer" and "Any Coordinator"; and "Choose Data Sets (choose multiple):" with a list of data sets including "NAACC (after 6/1/2015)", "UMass Stream Continuity Project (2005-2017)", "Connecticut (2004-2013)", "Vermont (11/20/2002-10/29/2015)", "Maine (2007-2015)", and "New Hampshire (2006 - 2016)". A "Search" button is located at the bottom right of the form. Annotations with arrows point to the "Location" dropdown, the "Choose Data Sets" list, and the "Search" button.

Figure 4: The North Atlantic Aquatic Connectivity Collaborative online search page provides access to information on culverts that have been assessed for aquatic passage.

Select the Crossing Code for a crossing to see the full record (see the following page for an example record).

Each record contains “Crossing Data” (Figure 5) which includes basic information on the location and type of crossing and the date and conditions under which it was evaluated. If photos are available, they will be shown at the top of the screen.

Each record also contains “Structure Data” (Figure 6. You may need to scroll down to see this set of data). This set of data provides information on the shape and size of the crossing as well as stream characteristics around and through the crossing.

FIGURE 5

Crossing Data:	
Database Entry By: No data	Entry Date: 05-06-2016
Coordinator: Erin Rodgers	Last Updated: 05-06-2016
GPS to Crossing Distance (meters): 3.0	NHD-HUC8 Watershed: Deerfield
Crossing Code: xy4255478872826006	Local ID: No data
Date Observed: 04-27-2016	Lead Observer: Devin Fitzgerald
Town/County: Ashfield, MA	Stream/River: Trib Upper Branch Clesson Brook
Road: Tatso Road	Type: Paved
GPS: Lat: 42.55477, Long: -72.82597	
Location Description: Near outlet of small pond on inside of the curve on Tatso Road	
Crossing Type: Culvert	Number of Culverts/Bridge Cells: 1
Flow Condition: Typical low-flow	Crossing Condition: OK
Tidal Site: No	Alignment: Skewed (>45°)
Road Fill Height (feet) : 0.01	Bankfull Width (feet): 6
Bankfull Width Confidence: High	Constriction: Severe
Tailwater Scour Pool: Large	
Crossing Comments: No data	
Evaluation of this stream crossing is estimated as: SEVERE BARRIER	

Figure 5: The “Crossing Data” screen provides basic information on the type and location of the crossing.

FIGURE 6

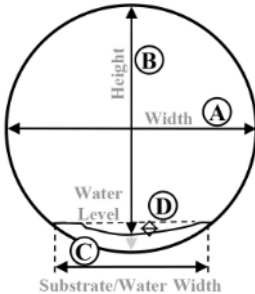
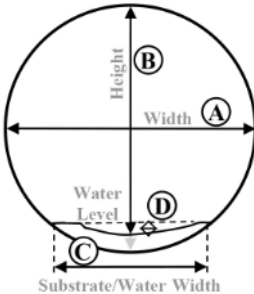
Structure Data:	
Total Number of Culverts: 1 This is culvert number 1 for this crossing:	
Outlet Openness Ratio: 0.028	Structure Material: Metal
Outlet Shape: Round Culvert	Outlet Armoring: None
Outlet Grade : Free Fall	Outlet dimensions (feet): A = 1.0; B = 1.3; C= 0.7; D = 0.10 ; E= No data
Outlet drop to water surface (feet): 1.3	Outlet drop to stream bottom (feet): 1.6
Structure Length: L = 27.7 Feet	
<hr/>	
Inlet Openness Ratio: 0.048	Inlet Shape: Round Culvert
Inlet Type: Projecting	Inlet Grade: At Stream Grade
Inlet dimensions (feet): A = 1.3; B = 1.3; C = 0.8; D = 0.20	
<hr/>	
Slope Percent: No data	Slope Confidence: No data
Internal Structures: None	Internal Structures Comment: No data
Structure Substrate Matches Stream: Comparable	Structure Substrate Type: Sand
Structure Substrate Coverage: 25%	Physical Barriers: None
Severity: None	Water depth matches that of the stream? No-Shallower
Water velocity matches that of the stream? No-Faster	Dry passage through structure? No
Height above dry passage: No data	
Structure Comments: No data	
<hr/>	
Inlet Shape:	Outlet Shape:
	
Round Culvert	Round Culvert

Figure 6: The “Structure Data” screen provides information on the size of the structure and stream characteristics around the crossing.

SHEDS: Stream Crossing Explorer⁴

The Stream Crossings Explorer (SCE) tool (Figure 7) is an online data tool that helps locate road-stream crossings based on the interests of the user. SCE conveys information about the vulnerability of road-stream crossings to heavy precipitation events. The five factors considered when determining vulnerability are structural, geomorphic, and hydraulic condition,⁵ the potential for disruption of emergency medical services, and the potential for improvement of aquatic organism passage. The tool was designed for state and municipal agencies, local decision-makers, regional planners, conservation organizations, and natural resource managers. The tool was developed by the Massachusetts Department of Transportation (MassDOT) and the University of Massachusetts, Amherst. The Deerfield River Watershed served as the pilot area for the tool. The project was funded by MassDOT and the Department of the Interior Hurricane Sandy Mitigation Fund, with additional support provided by the U.S. Geological Survey, the U.S. Forest Service, and the University of Massachusetts, Amherst.

To access the online data tool go to:

<http://sce.ecosheds.org/>

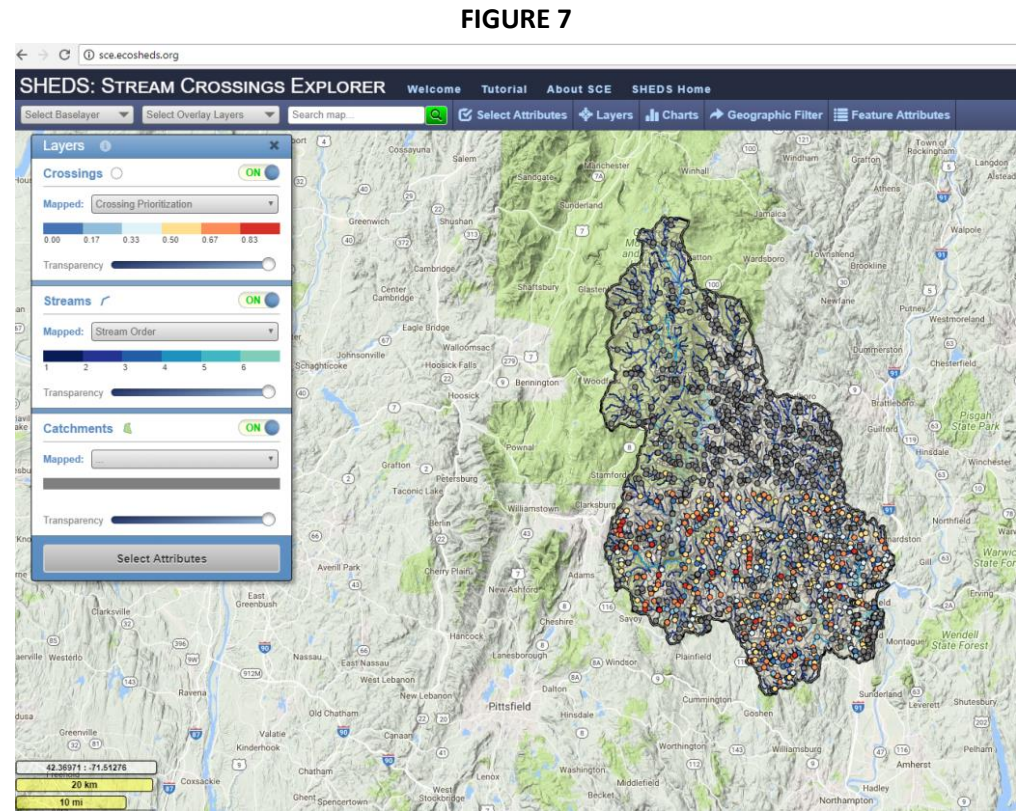


Figure 7: The SHEDS Stream Crossing Explorer is an online data tool with information about the vulnerability of road-stream crossings to heavy precipitation events.

⁴ The SHEDS: Stream Crossing Explorer tutorial is courtesy of work completed by a UMass Amherst student through the UMass Center for Agriculture, Food and the Environment's 2018 Summer Policy Scholars Pilot Program.

⁵ These terms are defined in the beginning of this report on page 4.

There are a series of key words, defined below, that make the tool useful at different scales.

1. A 'layer' is a collection of features – crossings, streams or catchments. This is found and can be manipulated at the top left of the screen (Figure 8).

FIGURE 8

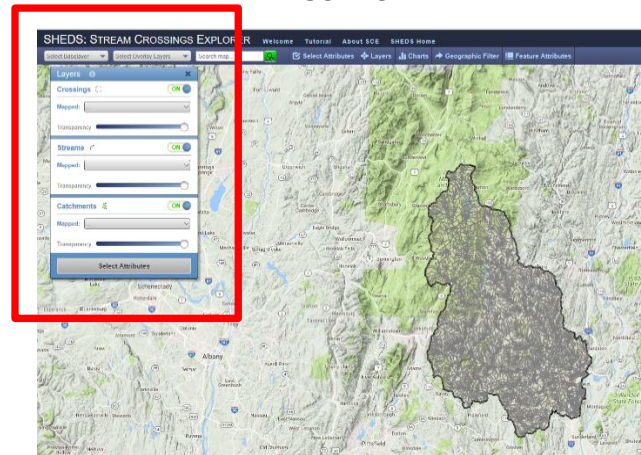


Figure 8: Layers are collections of features and can be found in the top left of the screen.

2. A 'feature' is a representation of a real world object. The colored dot in the first image represents a crossing. The blue line in the second image represents a stream. The green gradient in the third image represents a catchment.

FIGURE 9

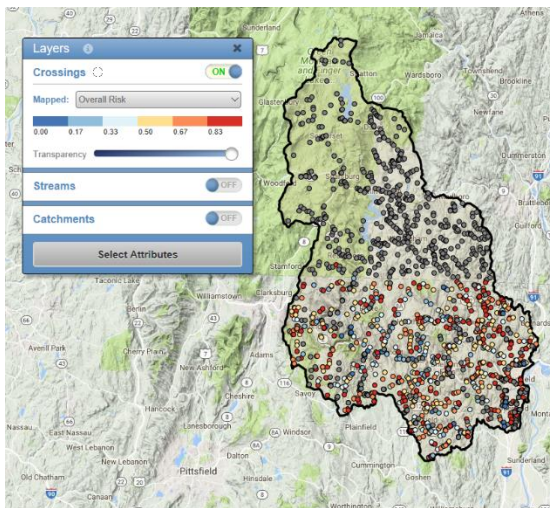


Figure 9: The dots represent crossings.

FIGURE 10

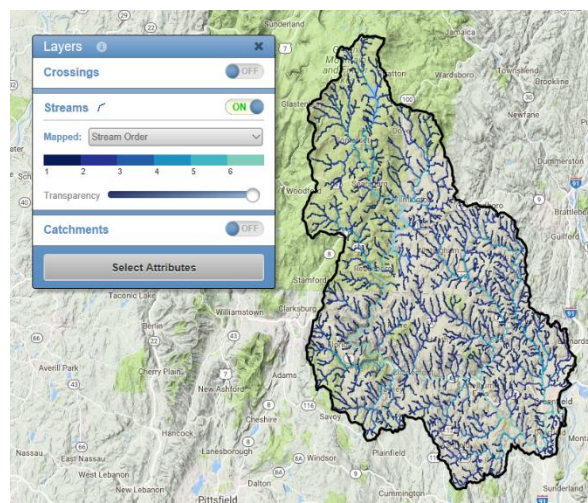


Figure 10: The blue lines represent streams.

FIGURE 11

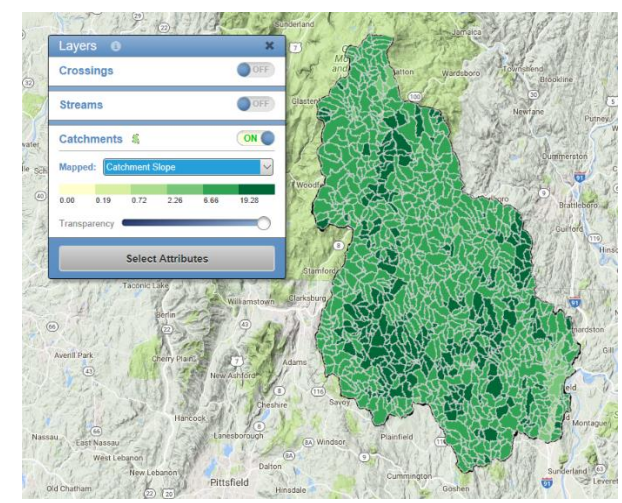


Figure 11: The green gradients are catchment areas.

3. An 'attribute' gives us information about a specific feature. This can be accessed by clicking on the drop down menu adjacent to the layer (displayed on Figure 12). The tool selects 5 default attributes to be viewed. By clicking on the 'Select Attribute' at the bottom of the 'Layers' window, you can view all the available attributes (displayed on Figure 13).

FIGURE 12

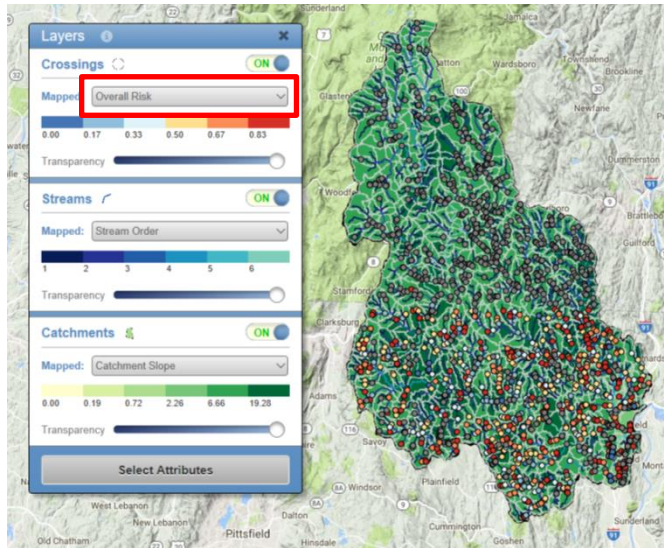


Figure 12: Attributes can be accessed by clicking on the drop down menu adjacent to the layer.

FIGURE 13

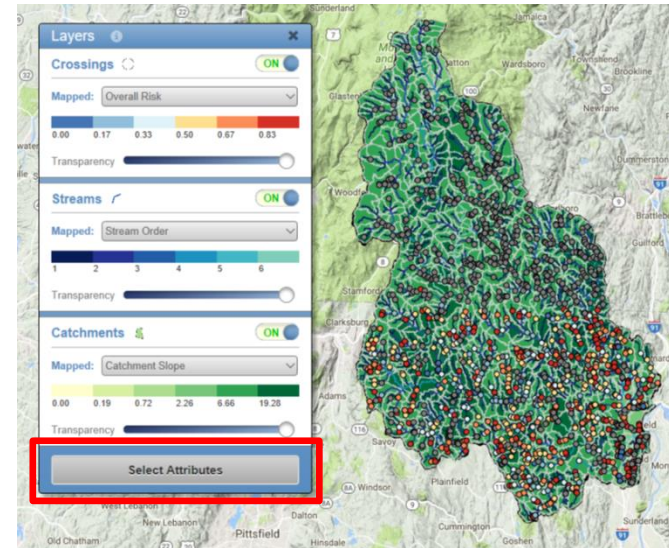


Figure 13: To view all available attributes, click on "Select Attributes" at the bottom of the window.

4. By clicking on the 'Select Attribute' tab, a window will open that allows you to view and select which attributes apply to your case or scenario. Selecting the appropriate attributes adds them to the feature's respective drop down menus. This window displays more options for analysis and is useful when conducting more in-depth research of a crossing. You can also choose to 'Continue with Default Selections' at the bottom of the window.

FIGURE 14

The 'Attribute Selection' window is titled 'Attribute Selection' and includes a subtitle: 'Selecting an attribute makes it available as a dropdown option for mapping in the 'Layers' window and graphing in the 'Charts' window'. The window is divided into several sections:

- Crossings**
 - Combined Scores**
 - ☒ Crossing Prioritization (Transportation Vulnerability & Ecological Disruption)
 - ☒ Transportation Vulnerability (Overall EMS Delay & Overall Risk of Failure)
 - Ecological Disruption**
 - ☒ Ecological Disruption
 - ☐ Impassability Score
 - ☐ Connectivity Loss
 - ☐ Connectivity Restoration Potential
 - ☐ Anadromous Restoration Potential
 - Coldwater Restoration**
 - Current: ☐ 16° C ☐ 18° C ☐ 20° C ☐ 22° C
 - Future: ☐ 16° C ☐ 18° C ☐ 20° C ☐ 22° C
 - ☐ Select All
 - Emergency Services Disruption**
 - ☒ Overall EMS Delay
 - ☐ Average EMS Delay
 - ☐ Average Affected EMS Delay
 - ☐ Maximum EMS Delay
 - ☐ Select All
- Risk of Failure**
 - ☒ Overall Risk
 - ☐ Structural Risk
 - ☐ Geomorphic Risk
- Hydraulic Risk Models**
 - Current: ☐ All ☐ Physical ☐ Statistical
 - Mid-Century: ☐ All ☐ Physical
 - ☐ Select All
- Additional Attributes**
 - ☐ Crossing Type
 - ☐ Drainage Area (Total)
 - ☐ Drainage Area (Connected)
 - ☐ Stream Length (Total)
 - ☐ Stream Length (Connected)
 - ☐ Structure Count
 - ☐ Stream Slope
 - ☐ Q2 Discharge
 - ☐ Unit Stream Power
 - ☐ Assessment Date
 - ☐ Road Jurisdiction
 - ☐ National Highway System
 - ☐ Select All

Streams

- ☒ Stream Order
- ☒ Trout Habitat Suitability
- ☒ Stream Temperature Resistance
- ☒ Select All

Catchments

- ☒ Elevation
- ☒ Catchment Slope
- ☒ Forest Cover
- ☒ Agriculture
- ☒ Water Cover
- ☒ Impervious Surface
- ☒ Select All

Continue with Default Selections

Figure 14: You can view and select which attributes will apply to your scenario, or continue with the default selections.

FIGURE 15

5. There are various other manipulations that can be done using this tool in order to acquire a more accurate result:
 - a. You can click on an object (crossing, catchment or stream) within the map to view all attributes of that specific feature. This window displays all the information of a specified object, including attributes that have not been selected.
 - b. You can switch features on and off by clicking on the slider adjacent to the feature title. By switching off a layer, you can view a clearer image of the map, while focusing on a feature that applies to your case.
 - c. You can adjust the transparency of a feature by moving the slider back and forth. This allows certain features in this tool to stand out, while still retaining information from the others.

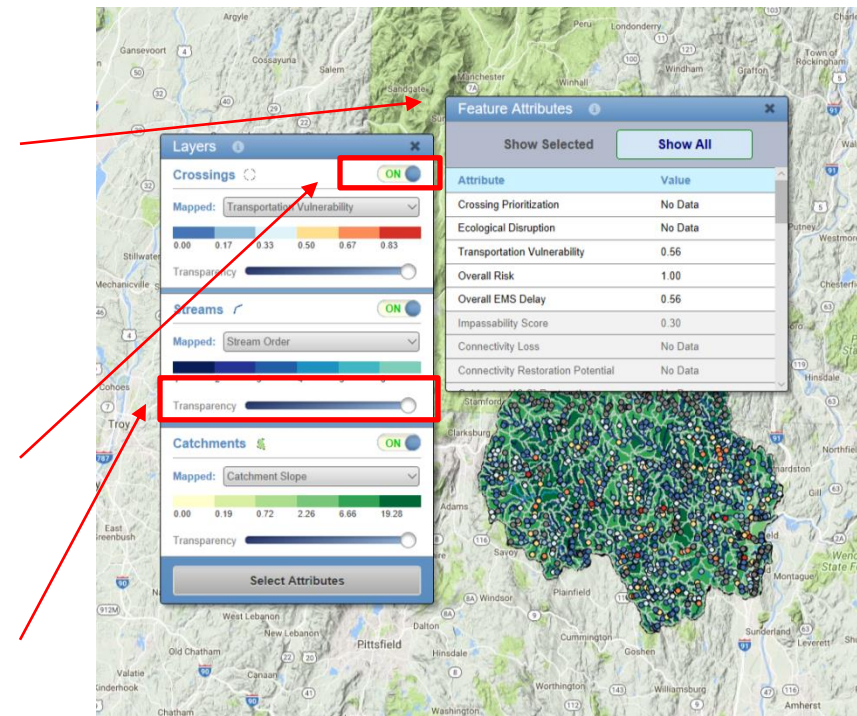


Figure 15: There are various ways to access, view, and refine information using the tool.

6. To restrict features on the map to a certain region click the 'Geographic Filter' tab at the top of the screen. You can then select the areas or regions of interest from the drop down menus available.

FIGURE 16

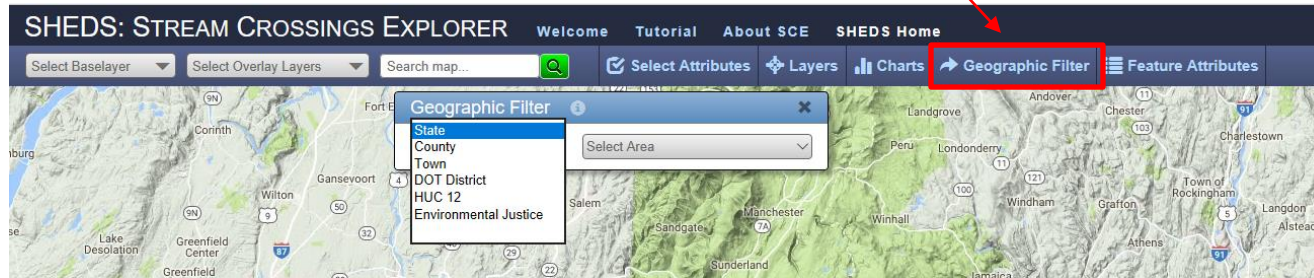


Figure 16: The "Geographic Filter" allows you to choose a specific region or town to focus on.

7. To display the data for any attribute to identify a trend, you can use the 'Chart' tool. This tab allows you to create a graph between different features to cross analyze, compare and prioritize which feature might need immediate remediation. You can do this by clicking on the 'Charts' tab at the top of the screen. This will open a window where you can select which 'Spatial Join' you want to use and then select which attribute you want to display in a graph.

FIGURE 17

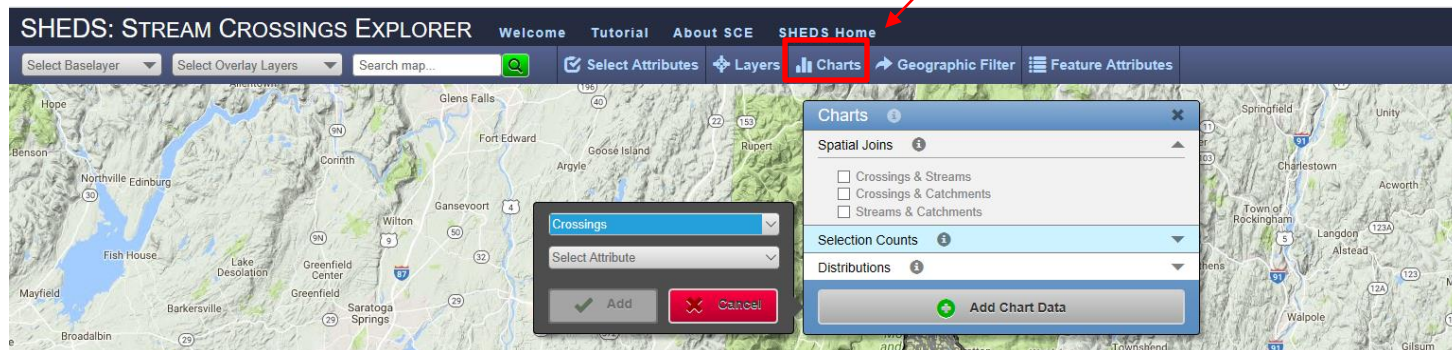


Figure 17: The "Charts" tool allows you to create a graph of different features.

Funding Opportunities for Upgrading Stream Crossings

Chapter 90 Funding (Massachusetts Department of Transportation)

The Chapter 90 program is a State funding program that entitles municipalities to reimbursement for capital improvement projects for road construction, preservation, and improvement that create or extend the life of capital facilities. The funds can be used for maintaining, repairing, improving, or constructing town and county ways and bridges that qualify under the State Aid Highway Guidelines. Items eligible for Chapter 90 funding include project design, roadways, sidewalks, right-of-way acquisition, shoulders, landscaping and tree planting, roadside drainage, street lighting, and traffic control devices. Each municipality in Massachusetts is granted an annual allocation of Chapter 90 reimbursement funding that it is eligible for, and the municipality can choose among any eligible infrastructure investments. <https://www.mass.gov/chapter-90-program>

Culvert Replacement Municipal Assistance Grant Program (Massachusetts Division of Ecological Restoration)

The Division of Ecological Restoration's Culvert Replacement Municipal Assistance Grant Program is for Massachusetts municipalities interested in replacing an undersized, perched, and/or degraded culvert located in an area of high ecological value. The purpose of this funding is to encourage municipalities to replace culverts with better designed crossings that meet improved structural and environmental design standards and flood resiliency criteria. Only projects that intend to meet the goals of the Massachusetts Stream Crossing Standards will be considered for funding. <https://www.mass.gov/how-to/culvert-replacement-municipal-assistance-grant-program>

Federal 604b Water Quality Management Planning Grant Program (Massachusetts Department of Environmental Protection)

This Federal funding program, administered by the Massachusetts Department of Environmental Protection, is authorized under the Federal Clean Water Act Section 604(b) for water quality assessment and management planning. Eligible entities include: regional planning agencies, councils of governments, conservation districts, counties, cities and towns, and other state public planning agencies and interstate agencies. No local match is required. <https://www.mass.gov/service-details/grants-financial-assistance-watersheds-water-quality>

Hazard Mitigation Grant Program (Massachusetts Emergency Management Agency)

The Hazard Mitigation Grant Program, administered by the Massachusetts Emergency Management Agency, provides federal funds to states, territories, tribal governments, and other communities after a disaster to reduce or eliminate future risk to lives and

property from natural hazards. State and local governments, tribal organizations, and certain private non-profits may be eligible to apply for funding to cover projects including stormwater upgrades, drainage and culvert improvements, property acquisition, slope stabilization, infrastructure protection, seismic and wind retrofits, structure elevations, etc. <https://www.mass.gov/service-details/hazard-mitigation-grant-program-hmgrp>

MassWorks Infrastructure Program (Executive Office of Housing & Economic Development)

The MassWorks Infrastructure Program is a State funding program that funds a range of publicly owned infrastructure projects, including but not limited to streets, roads, curb-cuts, parking facilities, site preparation and improvements on publicly owned land, and pedestrian walkways, in order to prepare communities for long-term strength and sustainability, with particular emphasis on projects that support multi-family housing in walkable mixed-use districts, or that support economic development in weak or distressed areas. Each year, at least ten percent of funds will be set aside for projects in small, rural communities with a population of 7,000 or less to support economic or community development and improvements to enhance safety. <https://www.mass.gov/service-details/massworks-2018-round-opens>

Municipal Small Bridge Program (Massachusetts Department of Transportation)

This State funding program is a 5 year program to assist cities and towns with replacing or preserving bridges with spans between 10' and 20'. Each municipality may qualify for up to \$500,000 per year. These small bridges are not eligible for federal aid under existing programs. This program provides for state reimbursement to municipalities of up to 100% of the total design and construction cost of eligible projects. MassDOT and each selected municipality will enter into an agreement to reimburse funds for approved projects. <https://www.mass.gov/municipal-small-bridge-program>

Municipal Vulnerability Preparedness (MVP) Grant Program (Executive Office of Energy and Environmental Affairs)

The MVP Grant Program provides State funding to support cities and towns across the state to begin the process of planning for climate change resiliency and implement priority projects. The state awards communities with funding to complete vulnerability assessments and develop action-oriented resiliency plans. Communities who complete the MVP program become certified as an MVP community, and are then eligible for MVP Action grant funding to advance priority actions that address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts. Projects that propose nature-based solutions or strategies that rely on green infrastructure or conservation and enhancement of natural systems to improve community resilience are given priority for funding. <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

Pre-Disaster Mitigation (PDM) Grant Program (Massachusetts Emergency Management Agency)

The PDM Grant Program, administered by the Massachusetts Emergency Management Agency, provides Federal funds to states, territories, Indian tribal governments and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Federal funding for this nationally competitive grant program is generally an annual allocation (subject to Congressional appropriation). <https://www.mass.gov/service-details/pdm-fma-grants>

Section 319 Nonpoint Source Competitive Grant Program (Massachusetts Department of Environmental Protection)

This grant program is authorized under Section 319 of the Federal Clean Water Act for implementation projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution. In general, eligible projects must: implement measures that address the prevention, control, and abatement of NPS pollution; target the major source(s) of nonpoint source pollution within a watershed/subwatershed; contain an appropriate method for evaluating the project results; and must address activities that are identified in the Massachusetts NPS Management Plan. Proposals may be submitted to MA DEP by any interested Massachusetts public or private organization. To be eligible to receive funding, a 40% non-federal match is required from the grantee. <https://www.mass.gov/service-details/grants-financial-assistance-watersheds-water-quality>

Small Town Housing Choice Capital Grant Program (Massachusetts Department of Housing and Community Development)

Towns with populations under 7,000 and that have a Community Compact and no moratorium for new housing qualify to apply for this State funding program. Any municipal capital improvement may be eligible, though projects related to housing or economic development will receive higher priority. <https://www.mass.gov/how-to/small-town-housing-choice-capital-grant-program>

Transportation Improvement Program (MassDOT)

The Transportation Improvement Program (TIP) is a prioritized, multi-year listing of transportation projects in a region that are to receive Federal funding for implementation. Projects are limited to certain roadways and are constrained by available funding for each fiscal year. Any transportation project in Franklin County that is to receive federal funding must be listed on the TIP.

Projects are chosen and prioritized by the Franklin County Transportation Planning Organization (TPO), which is made up of state, regional, and local officials. Towns are responsible for paying for design and any Right of Way work, but construction is funded 80% by Federal funds, and 20% by State funds. The typical timeframe for a project listed on the TIP is ten years, but the payoff for a town is that the construction is paid for 100%. <https://frcog.org/program-services/transportation-planning/>

USDA Community Facilities Direct Loan & Grant (United States Department of Agriculture Rural Development)

This Federal funding program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. Rural areas include cities and towns with no more than 20,000 residents as of the last U.S. Census. Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment and pay related project expenses. Communities with a population of 5,500 or less and/or with a median household income below 80% of the state nonmetropolitan median household income receive priority for funding. <https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program/ma>